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MANUFACTURE OF SOLAR DIRTY WATER RECYCLING TOOL USING FLAT PLATE COLLECTOR

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Abstract

The astromi indonesia traversed a line equator Provides the potential for maximum solar energy, this energy source be used to recycle water. Indonesia as a country maritime had area of water 62,89% from area of Indonesia, but this fact does not guarantee the large number of clean water supplies in each region. The instrument recycle water with solar energy designed to produce clean water be used solar radiation absorbed by flat plate collector will Help the process of evaporation dirty water A container at the top of a collector, So that will yield water vapor and the condensed form the grain of the water (condensate) On the surface of cover collector, so Of the water where they cleansed and pruned already can be funneled into a clean water storage. The rate of volume clean water every hour is 217,5 ml with temperature 37,2^{o}C and The intensity of sunlight on cover collector is 350 Cd. This clean water can not be consumed by body and Need to processed further by a chemical process.
Keywords: *the recycled water; Solar energy; Flat plate collector*

Abstrak

Letak astronomis Indonesia yang dilewati oleh garis khatulistiwa memberikan potensi yang sangat baik dari sumber energi surya, sumber energi ini dapat dimanfaatkan dalam berbagai aspek kehidupan salah satunya untuk daur ulang air kotor. Indonesia sebagai negara maritim yang memiliki luas daerah perairan sekitar 62,89 % luas Indonesia, tetapi hal ini tidak menjamin banyaknya sumber air bersih yang merata disetiap daerah. Alat daur ulang air kotor tenaga surya dirancang untuk menghasilkan air bersih, dengan memanfaatkan radiasi matahari yang diserap oleh kolektor pelat datar maka akan membantu proses penguapan air kotor yang diletakkan dalam bejana tepat di atas kolektor, sehingga akan menghasilkan uap air dan terkondensasi membentuk butir-butir air (kondensat) yang menempel pada permukaan penutup alat yang terbuat dari kaca sehingga dapat dialirkan ke penyimpanan air yang sudah bersih. Volume air bersih rata-rata yang dihasilkan setiap jam adalah 217,5 ml dengan suhu sekitar 37,2 oC dan intensitas cahaya matahari yang mengenai tutup kaca sebesar 350 Cd. Air bersih yang dihasilkan ini tidak dapat dikonsumsi langsung oleh tubuh manusia dan perlu diolah lebih lanjut dengan proses kimia.
Kata Kunci:: Daur ulang air; Tenaga surya; Kolektor pelat datar.

I. INTRODUCTION

Indonesia is located on the equator which can receive an average of 8 hours of sunlight per day, the potential of this solar energy can be used for the development of solar water recycling tools as an alternative energy to replace fossil fuels.

The application of a water recycling system using solar energy can be utilized as much as possible in remote areas that have not been reached by PAM or other clean water sources. The use of solar energy in the recycling system can obtain clean water without having to spend large funds, but the water produced from the recycling system is not suitable for direct consumption by the human body because it does not contain the mineral salts needed by the body, so it needs to be further processed chemically so that the recycled water can be consumed by the human body. (Ferdinan, M.2008).

The manufacture of solar dirty water recycling tools is sought to help people in areas where it is difficult to get clean water so that the dirty water recycling results can be used for household purposes such as washing and bathing.

The amount of power that comes out of the sun's surface is about 3.7 x 1023 KW, this solar power is used for people's needs both conventionally and after changing it first to another form as needed.

Flat plate collector is one of the tools used to convert solar energy into heat energy that can produce temperatures below 100o C. In addition, this solar collector is also very simple, easy to maintain so that people can easily use it.

II. LITERATURE REVIEW

The sun is a huge source of energy and will never run out. The Sun has a diameter of about 1.39 x 106 Km and is about 1.5 x 108 Km from the earth. The effective temperature on the surface of the sun is about 5800 K, while in the inner part of the sun the temperature is even greater, which is around 8×106 K to 40×106 K and the density of the sun is about 80 - 100 times the density of water. The amount of power that comes out of the sun's surface is about 3.7 x 1023 KW, this solar power is used for drying, distillation and other needs by the community both conventionally and after changing it first to other forms according to needs.

The solar energy that gets to the dirty water recycling device cover will be passed to the water and subsequently to the solar collector. The heat that has entered the dirty water recycling tool will heat the water, so that this water experiences an increase in temperature and evaporates, and when it reaches the cover of this recycling tool it will condense and

turn into water spots. These water spots will flow because the cover is made at an angle so that it can flow into the reservoir.

The amount of heat absorbed by the water in the water reservoir can be expressed by:

$Q = mc\Delta T$ .....(1)

With Q = amount of heat absorbed (cal)

m = water time (g)

ΔT = temperature change (K)

c = water type heat (cal/g °C)

The amount of heat absorbed by this solar collector depends on the intensity of solar radiation reaching the surface of the dirty water recycling device, The intensity of sunlight can be expressed by the following equation,

$$I = 840\frac{\triangle T}{t}$$

.....(2)

With I being the intensity of light (Cd), ΔT is the change in temperature (K) and t is the time (s).

Heat transfer can occur through three types of mechanisms, namely: Heat transfer by radiation, heat transfer by conduction, and heat transfer by convection.

The magnitude of the mass transfer rate is expressed by:

$$\dot{m}_d = 9{,}15x10^{-7}(P_{wb} - P_{wg})$$

.....(3)

where: ṁd = time transfer rate (kg/m2s). (Ginting, M. 1999).

Solar dirty water recycling technology is used both for water purification, as well as converting seawater into fresh water (distillation). Basically, this technology operates through evaporation processing followed by condensation. Solar distillation is very useful for purifying water from harmful pollutants. When it is heated, the water evaporates while pollutants are left behind, due to the difference in volatility. In the case of distillation, the pure water that no longer contains salt evaporates and condenses while salt and other minerals remain. Thus, a relatively pure and clear water distillate will be obtained.

III. RESEARCH METHOD

In this study, an experimental method was carried out, where this method was carried out in two stages, namely the stage of making dirty water recycling tools and the tool testing

stage. The tools used in testing this tool are thermometers to measure the temperature inside and outside the recycling tool, the simple Ogawa Seiki pylheliometer Co.LTD to measure the intensity of the sun and a measuring cup to measure the volume of clean water produced.

Dirty water recycling tools consist of glass covers or roofs, and walls made of zinc plate. On the bottom of the device is installed a zinc wave painted black as a heat collector that absorbs radiant energy. At the top of this heat collector is placed 2 cm high dirty water, to accommodate clean water attached to the glass cover or the roof is installed as a clean water reservoir, the scheme of the solar dirty water recycling tool can be seen in the following figure 1,

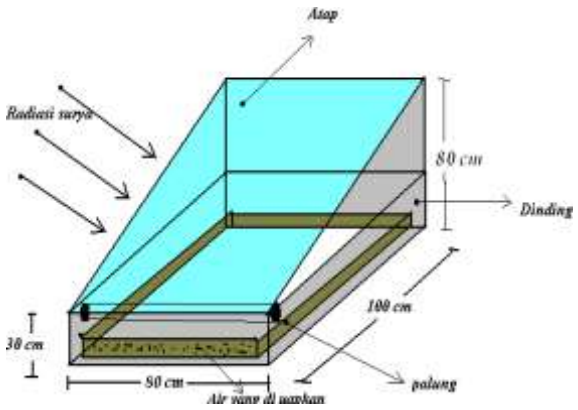

Figure 1 Solar dirty water recycling tool

The light intensity measuring device consists of a copper tube with a capacity of 43.2 cm3. By putting water in a simple pylheliometer tube, then put a thermometer in the tube to measure the initial temperature (Ti) and after 1 hour of measuring the final temperature (Tf), change the water in the tube and do it again up to 7 times with an interval of 1 hour.

To find out the ability of this dirty water recycling tool, it is necessary to know how much clean water mass is produced, this can be done by measuring the temperature in the dirty water recycling tool that has contained dirty water as high as 2 cm, previously weigh the mass of dirty water put into the tool and measure Ti and Tf every 1 hour starting from 09.30 WIB to 15.30 WIB, after 15.30 WIB weigh the mass of clean water stored in the clean water reservoir, and do it in the same way up to 5 times.

IV. RESEARCH RESULT AND DISCUSSION

The process of making a solar dirty water recycling tool takes 3 days, which aims to improve heat absorption by the heat collector. For testing the device, the intensity of light entering the collector is measured and the evaporation speed is calculated by knowing the mass of clean water produced every day.

The greater the intensity of sunlight that enters the device, the greater the mass of clean water produced, this can be seen in the following Table 1,

Table 1 Solar intensity and volume of water produced per observation hour

Hour (WIB)	I (Cd)	V (ml)
09.00-10.00	246.4	141.6
10.00-11.00	316.4	166.6
11.00-12.00	350	195.0
12.00-13.00	301	217.5
13.00-14.00	296.2	214.6
14.00-15.00	287	201.6

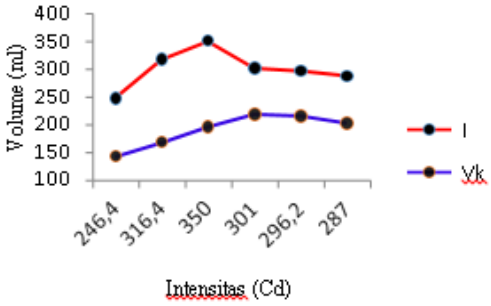

Figure 2 Graph of the relationship between light intensity (I) and the volume of water produced (V)

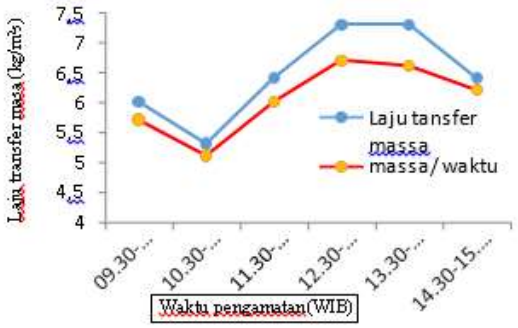

Figure 3 Graph of the relationship between the rate of water mass transfer at each observation time.

In Table 1, it can be seen that the largest volume of water can be produced at 12.00-13.00 WIB of 217.5 ml, this happens because at that time the collector is able to maximally absorb solar energy of 350 Cd. A graph of the relationship between sunlight intensity can be seen in Figure 2 where the greater the solar intensity obtained, the greater the volume of clean water produced. The rate of time transfer has increased from 10.30-

12.30 WIB and began to decrease from 13.30 WIB at the time of observation, this is due to the reduced intake of solar energy that hits the collector.

V. CONCLUSSIONS

Based on the results of the manufacture and testing of the tool in this study, it can be concluded that:

1. The maximum intensity of average sunlight received by collectors is 350 Cd at 11.00-12.00 WIB.
2. The maximum volume of clean water produced is 217.5 ml at the observation time of 12.00-13.00 WIB, because maximum evaporation occurs in the observation time range before 12.00 WIB.
3. The change in the rate of mass transfer is influenced by the amount of heat absorbed by the collector, where the rate of mass transfer of water increases from 10.00 WIB to 12.00 WIB, this is caused by increasing the temperature of the collector due to the maximum intensity of solar energy at that time.

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